LV32MX v6™

User manual

All MikroElektronika´s development systems represent irreplaceable tools for programming and developing microcontroller-based devices. Carefully chosen components and the use of machines of the last generation for mounting and testing thereof are the best guarantee of high reliability of our devices. Due to simple design, a large number of add-on modules and ready to use examples, all our users, regardless of their experience, have the possibility to develop their project in a fast and efficient way.

Development System

MikroElektronika

SOFTWARE AND HARDWARE SOLUTIONS FOR EMBEDDED WORLD ...making it simple

TO OUR VALUED CUSTOMERS

I want to express my thanks to you for being interested in our products and for having confidence in mikroElektronika.
The primary aim of our company is to design and produce high quality electronic products and to constantly improve the performance thereof in order to better suit your needs.

Nebojsa Matic
General Manager

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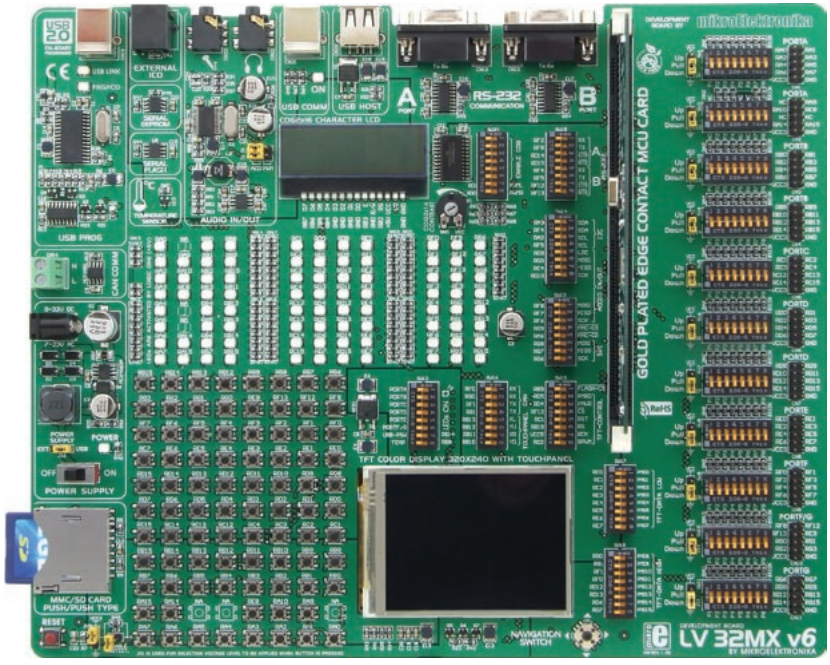
Introduction to LV32MX v6 Development System

The *LV32MX v6*™ development system provides a development environment for experimenting with PIC32™ microcontrollers from Microchip®. The system includes an on-board programmer PIC32Flash™ which serves as an interface between the microcontroller and a PC. You are simply expected to write a program, generate a .hex file and program your microcontroller using the *PIC32FLASH*™ program. Numerous modules, such as TFT display with a resoultion of 320x240, on-board 2x16 LCD, serial EEPROM module etc, are provided on the board and allow you to easily simulate the operation of the target device.



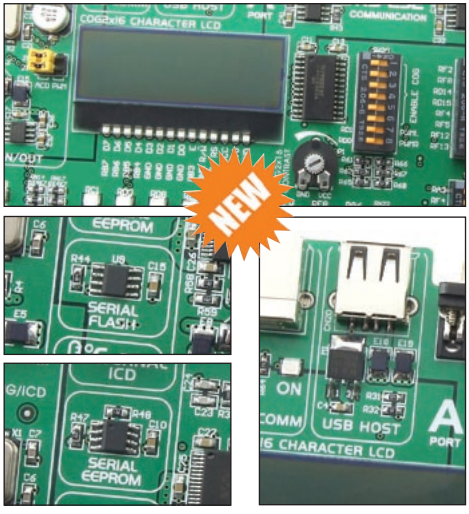
LV32MX MultiMedia BOARD — Full-featured development system for PIC32MX microcontroller based devices

USB 2.0 IN-CIRCUIT PROGRAMMER — On-board USB 2.0 programmer

TFT 320X240 Display — TFT display provides a palette of 262.000 colours and an integrated touch panel

MMC/SD MEMORY CARD — A possibility of reading MMC/SD memory cards

JOYSTICK — Navigation joystick used for easier orientation and navigation through the user menu



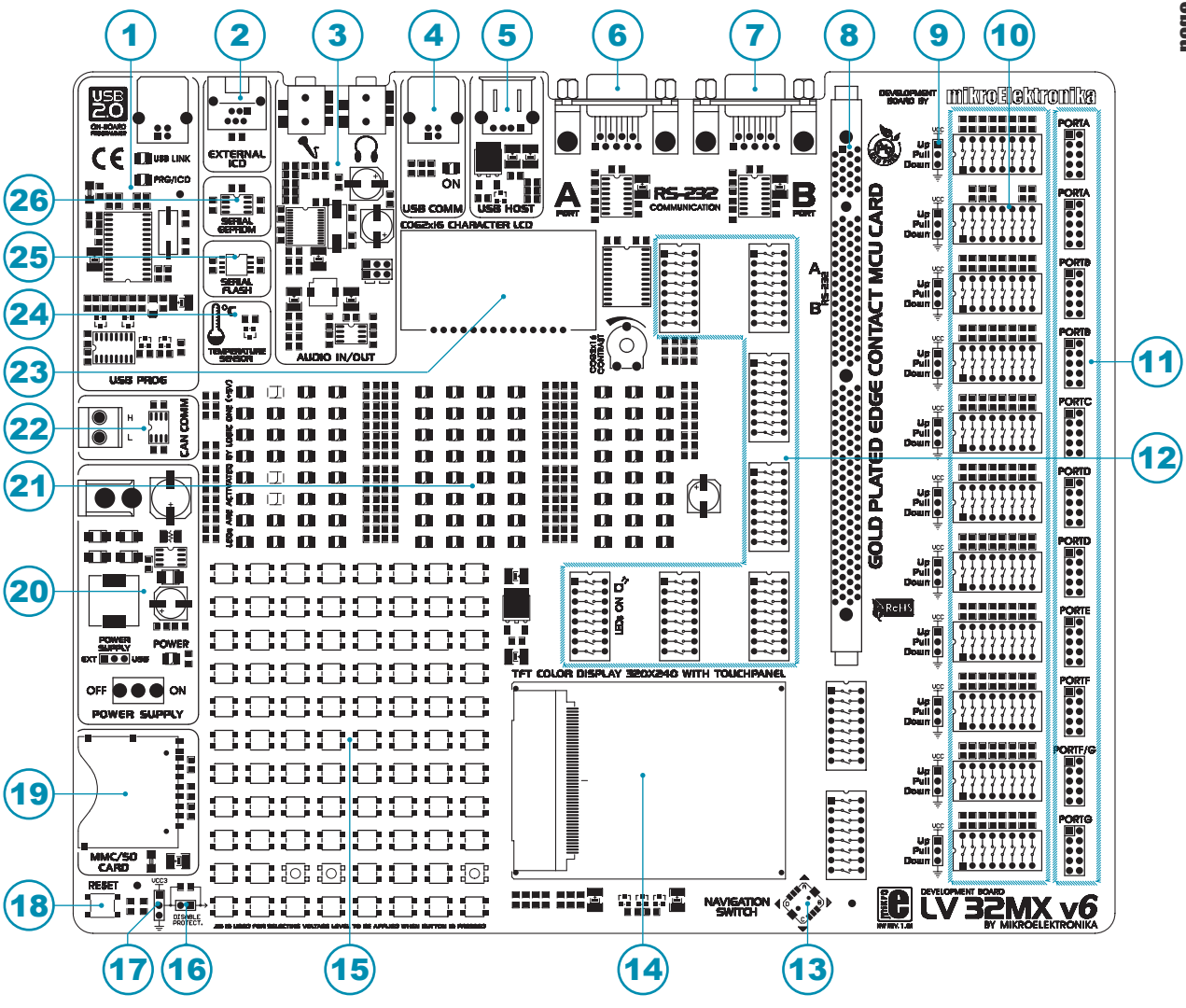
The *PIC32FLASH*™ program for programming provides a complete list of all supported microcontrollers. The latest version of this program with updated list of supported microcontrollers can be downloaded from our website at **www.mikroe.com**

Package contains:

Development system:	LV32MX v6
CD:	product CD with relevant software
Cables:	USB cable
Documentation:	Manual for LV32MX v6, quick guide for installing USB drivers and electrical schematic of the system

System specification:

Power supply:	over an AC/DC connector (7-23V AC or 9-32V DC); or over a USB cable for programming (5V DC)
Power consumption:	~40mA in idle state when all on-board modules are off
Dimension:	26,5 x 22cm (10,4 x 8,6inch)
Weight:	440g (0.97lbs)



Key Features

1. On-board programmer PIC32Flash
2. Connector for external programmer ICD2® or ICD3®
3. Audio module
4. USB communication connector
5. USB HOST connector
6. RS-232A communication module
7. RS-232B communication module
8. DIMM 168P socket for MCU cards
9. Jumper for pull-up/pull-down resistor selection
10. DIP switches enable pull-up/pull-down resistors
11. I/O port connectors
12. DIP switches turn on/off on-board modules
13. Navigation joystick
14. TFT display with integrated touch panel
15. Push buttons simulate microcontroller input pins
16. Jumper for shortening the protective resistor
17. Jumper for selecting push buttons' logic state
18. Reset button
19. MMC/SD card connector
20. Power supply voltage regulator
21. 85 LEDs indicate pins' logic state
22. CAN communication module
23. On-board 2x16 LCD
24. Temperature sensor
25. FLASH module
26. EEPROM module

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1.0. Connecting the System to a PC

Step 1:

Follow the instructions provided in the relevant manual and install the *PIC32FLASH* program and the USB driver from the product CD. They are essential for the proper operation of the on-board programmer.

Step 2:

Use the USB cable to connect the development system to a PC. One end of the USB cable, with a USB connector of B type, should be connected to the development system, as shown in Figure 1-2, whereas the other end of the cable with a USB connector of A type should be connected to a PC. When establishing a connection, make sure that jumper J16 is placed in the USB position as shown in Figure 1-1.

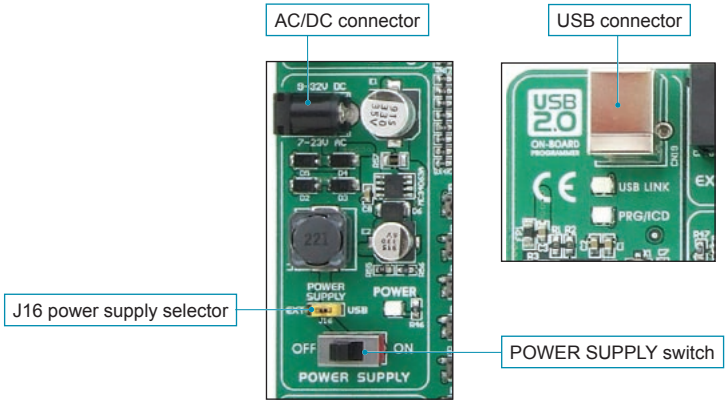

Figure 1-1: Power supply

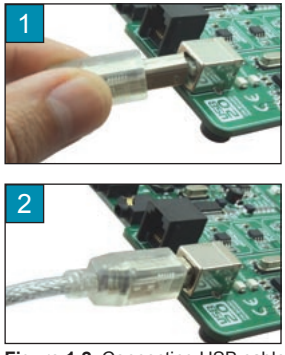

Figure 1-2: Connecting USB cable

Step 3:

Turn on your development system by setting the POWER SUPPLY switch to ON position. Two LEDs marked as POWER and USB LINK will be automatically turned on indicating that your development system is ready to use. Use the on-board programmer *PIC32Flash* and the *PIC32FLASH* program to dump a code into the microcontroller and employ the system to test and develop your projects.

NOTE: If some additional modules are used, it is necessary to place them properly on the development system while it is turned off. Otherwise, either can be permanently damaged. Refer to figure below for the proper placing of the additional modules.

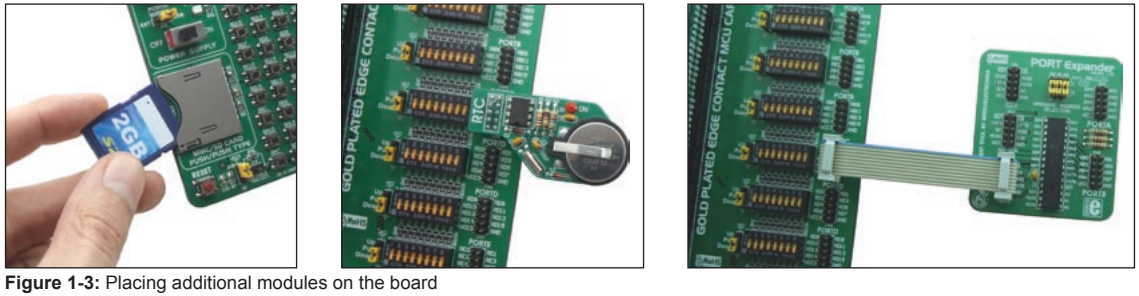

Figure 1-3: Placing additional modules on the board

2.0. Supported Microcontrollers

The *LV32MX v6* development system provides a DIMM-168P connector to place an MCU card into. This development system comes with an MCU card with the PIC32MX460F512L in 100-pin TQFP package soldered on it, Figure 2-3. Besides, the MCU card alone provides an oscillator as well as 102 soldering pads connected to microcontroller pins. Each pad is marked the same as the pin it is connected to. Soldering pads also make connection between the MCU card and target device's modules easy.

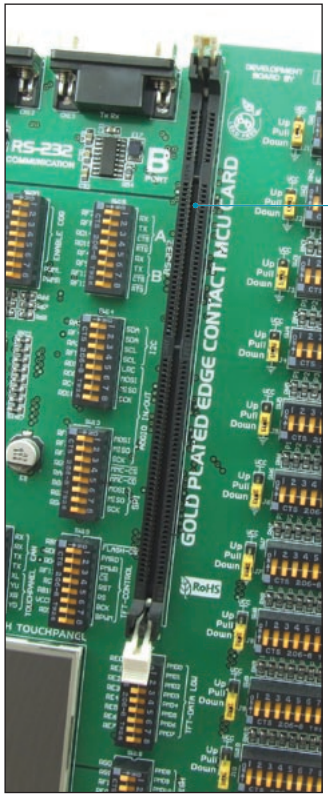

Figure 2-1: DIMM-168P connector

DIMM-168P connector for placing the MCU card with microcontroller in TQFP package

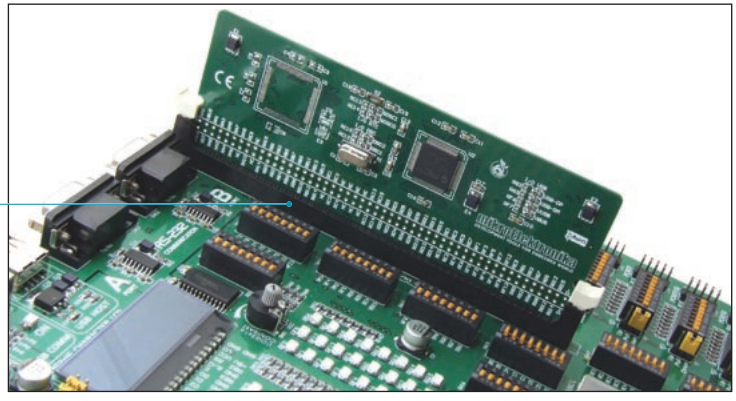

Figure 2-2: DIMM-168P connector with the MCU card inserted

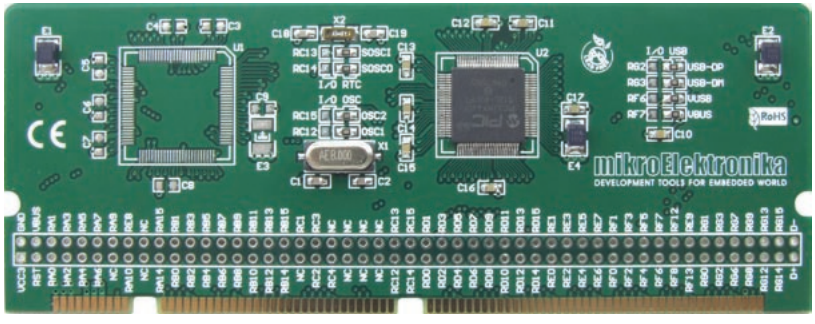

Figure 2-3: MCU card with a 100-pin microcontroller in TQFP package soldered on it

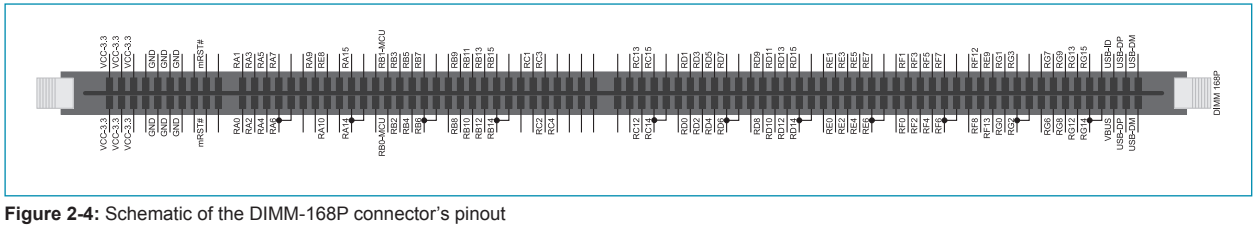

Figure 2-4: Schematic of the DIMM-168P connector's pinout

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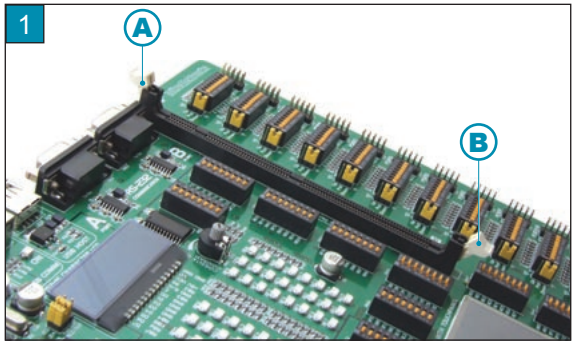
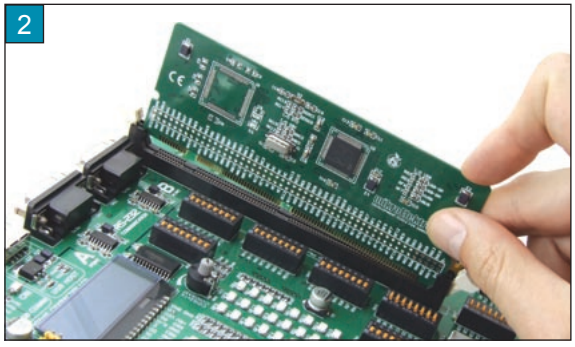
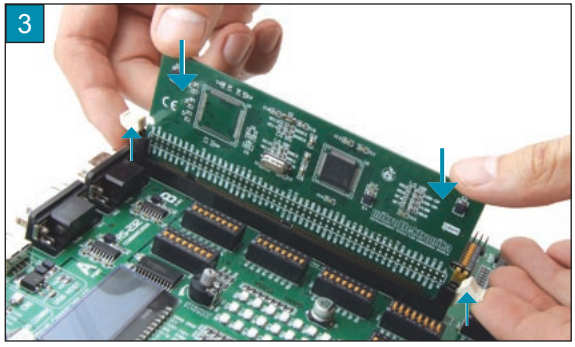
The MCU card should be placed into the DIMM-168P connector in the following way:



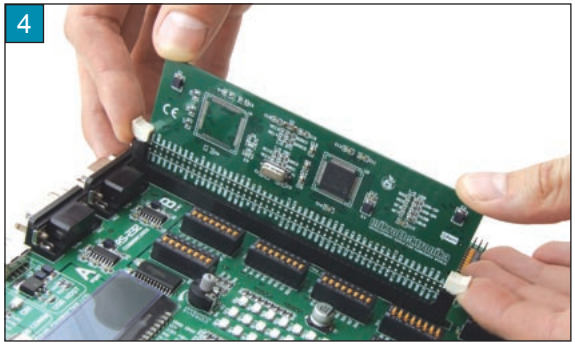
Open extraction levers A and B



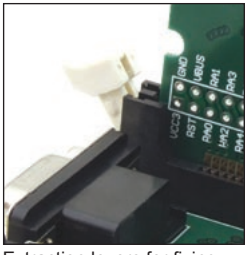
Insert the MCU card into the DIMM-168P connector

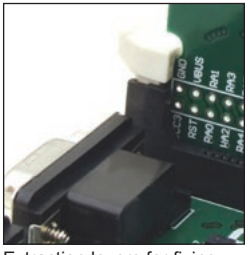


Push the MCU card down gently into the DIMM-168P connector and lift extraction levers slowly at the same time



Close the extraction levers when the MCU card is properly placed into the connector


Extraction levers for fixing the MCU card in ‘open’ position


Extraction levers for fixing the MCU card in ‘closed’ position

3.0. On-board PIC32Flash Programmer

A programmer is a necessary tool when working with microcontrollers. It is used to load a hex code into the microcontroller and serves as an interface between the microcontroller and the PC. The *LV32MX v6* has an on-board *PIC32Flash* programmer. The *PIC32FLASH* program is used for loading a .hex file into the microcontroller. Figure 3-3 shows connection between the compiler, *PIC32FLASH* program and the microcontroller.

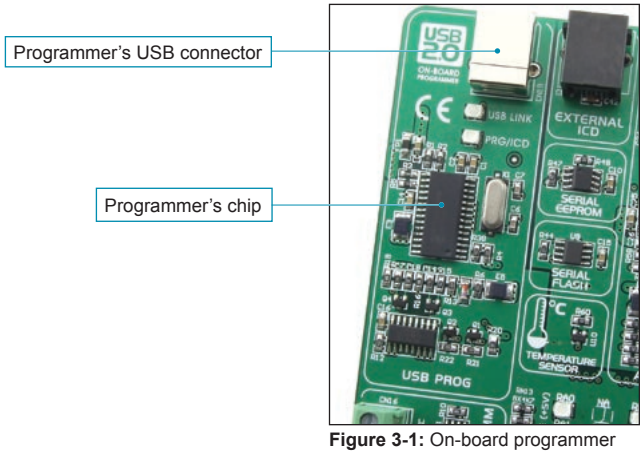


Figure 3-1: On-board programmer

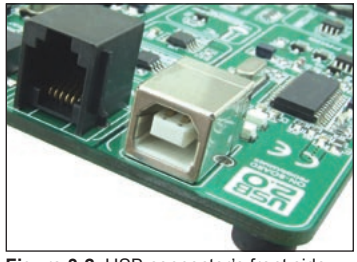
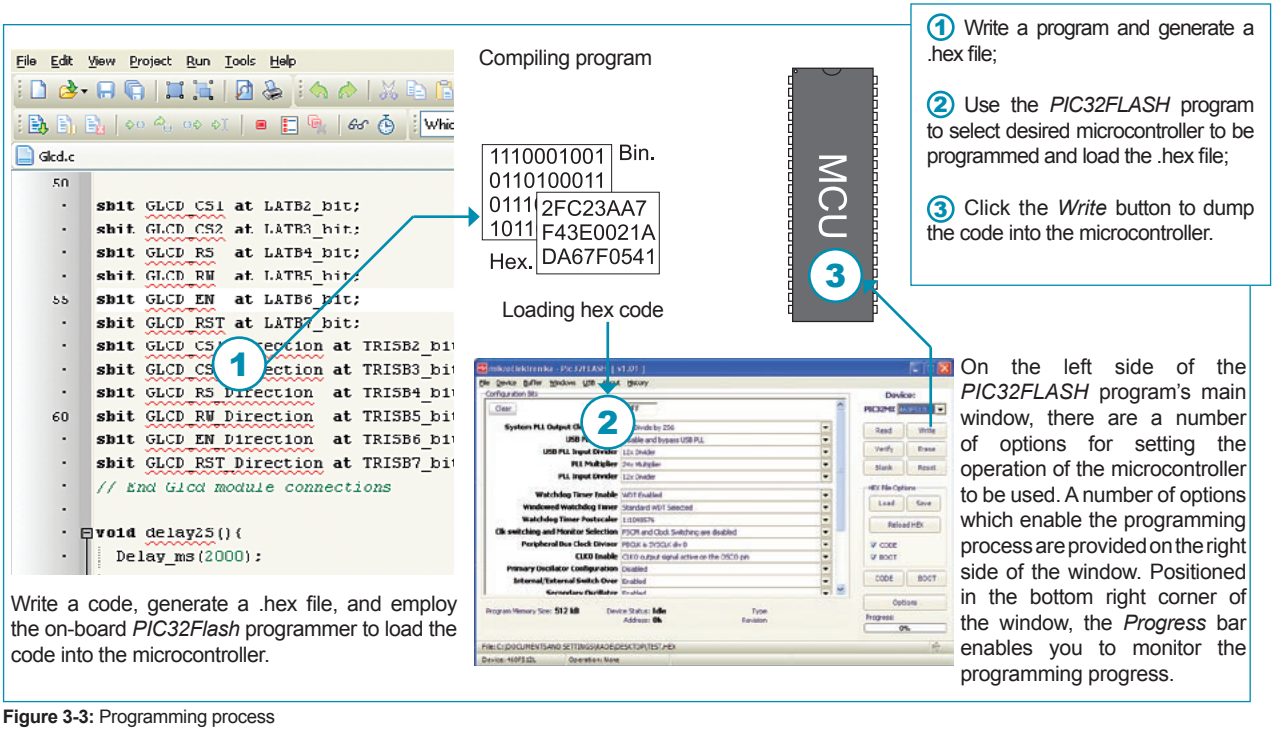


Figure 3-2: USB connector's front side


File Edit View Project Run Tools Help
Glcd.c
sbit GLCD_CS1 at LATB2_bit;
sbit GLCD_CS2 at LATB3_bit;
sbit GLCD_RS at LATB4_bit;
sbit GLCD_RW at LATB5_bit;
sbit GLCD_EN at LATB6_bit;
sbit GLCD_RST at LATB7_bit;
sbit GLCD_RS_Direction at TRISB4_bit;
sbit GLCD_RW_Direction at TRISB5_bit;
sbit GLCD_EN_Direction at TRISB6_bit;
sbit GLCD_RST_Direction at TRISB7_bit;
// End Glcd module connections
void delay25(){
Delay_ms(2000);
1
Compiling program
1110001001 0110100011 0111 1011
Bin.
2FC23AA7 F43E0021A DA67F0541
Hex.
Loading hex code
2
MCU
3
① Write a program and generate a .hex file;
② Use the PIC32FLASH program to select desired microcontroller to be programmed and load the .hex file;
③ Click the Write button to dump the code into the microcontroller.

Write a code, generate a .hex file, and employ the on-board *PIC32Flash* programmer to load the code into the microcontroller.

On the left side of the *PIC32FLASH* program's main window, there are a number of options for setting the operation of the microcontroller to be used. A number of options which enable the programming process are provided on the right side of the window. Positioned in the bottom right corner of the window, the *Progress* bar enables you to monitor the programming progress.

Figure 3-3: Programming process

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4.0. ICD Connector

In addition to the on-board *PIC32Flash* programmer, one of the external programmers ICD2 or ICD3 from Microchip can be used for programming microcontrollers. Connection between the external programmer and development system is established by means of the ICD connector.

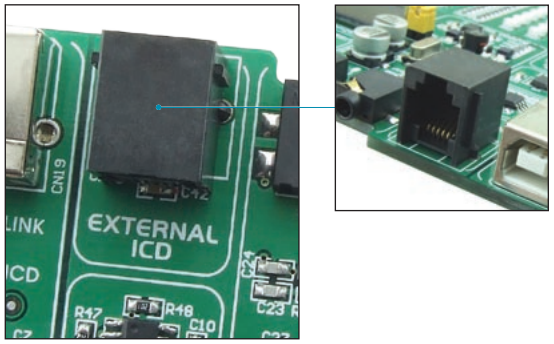

Figure 4-1: ICD connector

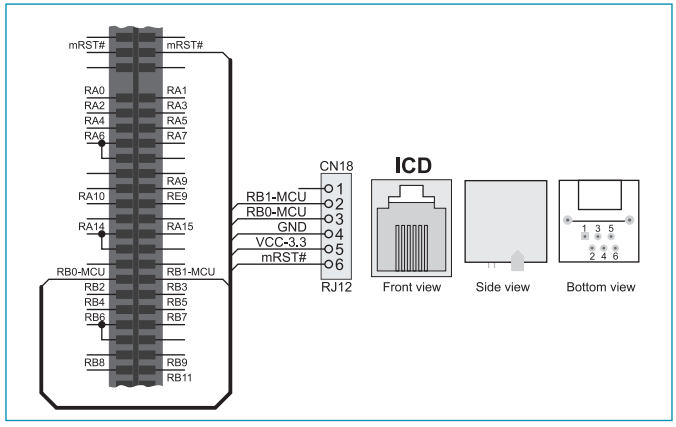

Figure 4-2: ICD connector and microcontroller connection schematic

For the .hex file to be loaded into the microcontroller, it is necessary to provide an adequate program. The MPLAB program from Microchip is the right one. You can use this program to write a code and load it afterwards into the microcontroller. By means of the *Programmer* option, contained in the MPLAB window, you can select a programmer to be used for loading the code into the microcontroller.

5.0. 3.3V Voltage Regulator

The *LV32MX v6* development system is provided with a voltage regulator whose purpose is to reduce the power supply voltage of the development system from 5V to 3.3V. The 3.3V power supply voltage is then used for powering the microcontroller and other on-board modules. The MC33269DT-3.3 circuit provided on the development system is used as a voltage regulator capable of providing 800mA current.

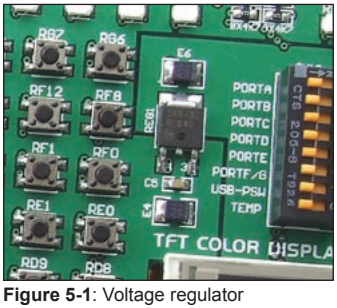

Figure 5-1: Voltage regulator

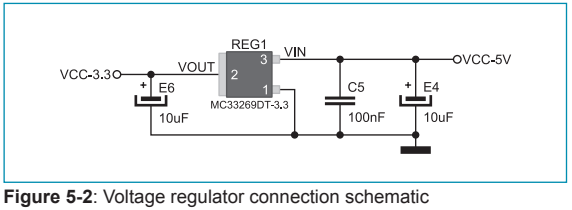

Figure 5-2: Voltage regulator connection schematic

6.0. Power supply

The *LV32MX v6* development system may use one of two power supply sources:

1. +5V PC power supply through the USB programming cable; and
2. External power supply source connected to an AC/DC connector provided on the development board.

The MC34063A voltage regulator and Gretz rectifier are used to enable external power supply voltage to be either AC (in the range of 7V to 23V) or DC (in the range of 9V to 32V). Jumper J16 is used as a selector of the power supply source. To take advantage of the USB power supply, jumper J16 should be placed in the USB position. When using the external power supply, jumper J16 should be placed in the EXT position. The development system is turned on/off by switching the position of the POWER SUPPLY switch.

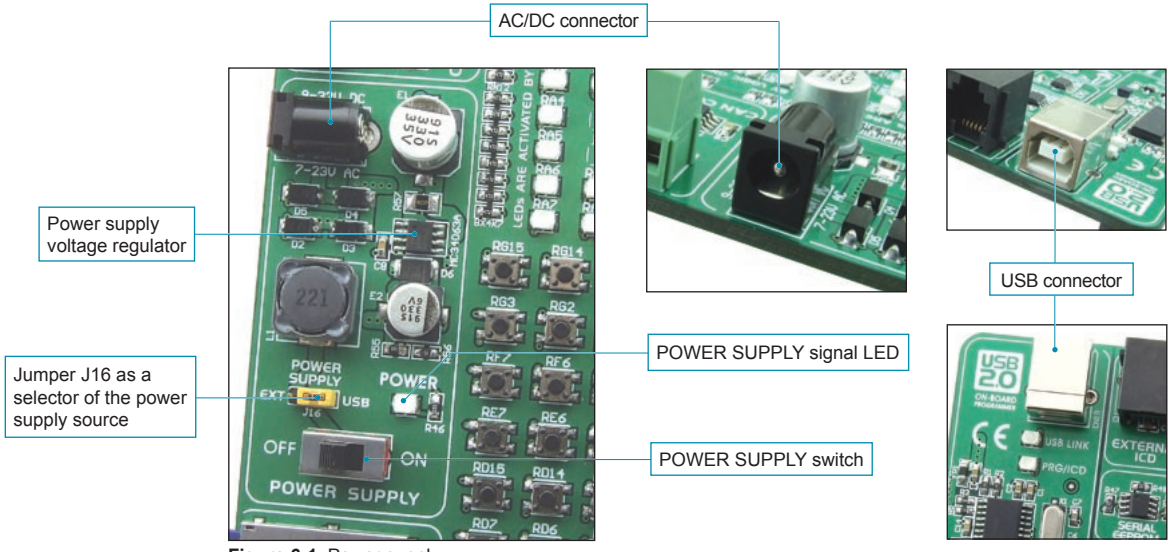

Figure 6-1: Power supply

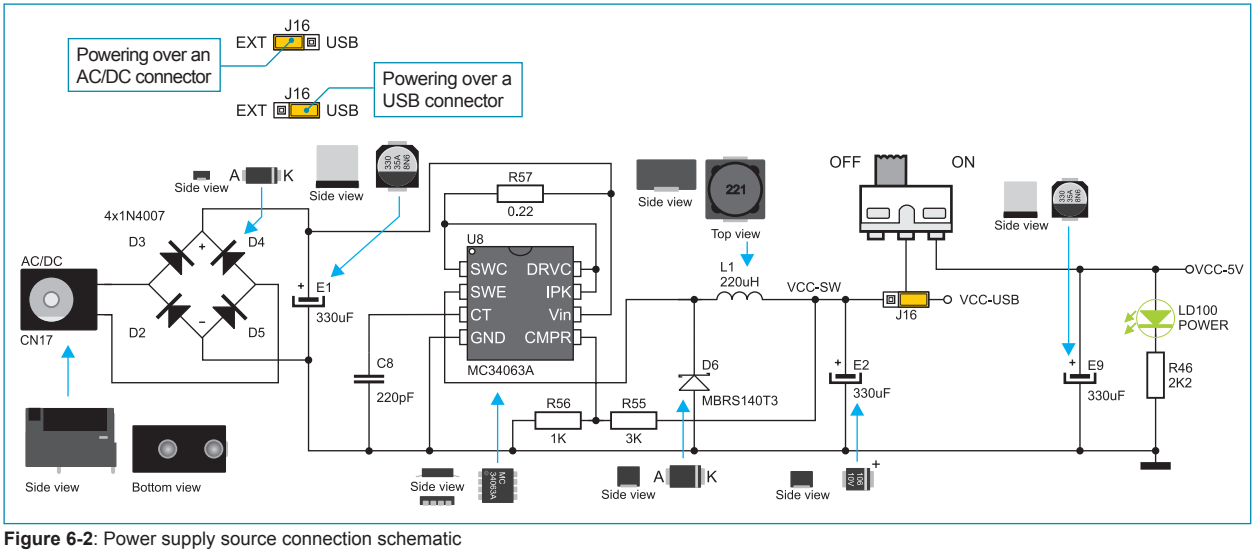

Figure 6-2: Power supply source connection schematic

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7.0. USB Communication Connector

The CN21 USB connector enables a PIC32 microcontroller with a built-in USB communication module to be connected to peripheral modules. The microcontroller is connected to the CN21 USB connector via USB-DM and USB-DP lines. The function of the LED marked as ON is to indicate connection between USB devices and the development system, hence the microcontroller.

Figure 7-1: USB connector

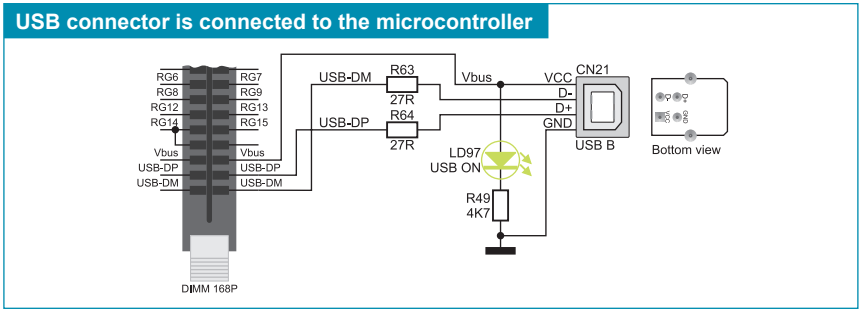

Figure 7-2: USB connector and microcontroller connection schematic

8.0. USB HOST Connector

The *LV32MX v6* development system can be linked to peripheral units, such as printer, USB flash memory etc. by means of the USB HOST connector. Communication between the microcontroller and USB devices is performed via RG2, RG3 and RB14 microcontroller pins. The USB HOST connector is linked to the microcontroller via the same pins as the USB communication connector so that it is not possible to use them simultaneously.

Figure 8-1: USB connector of A type

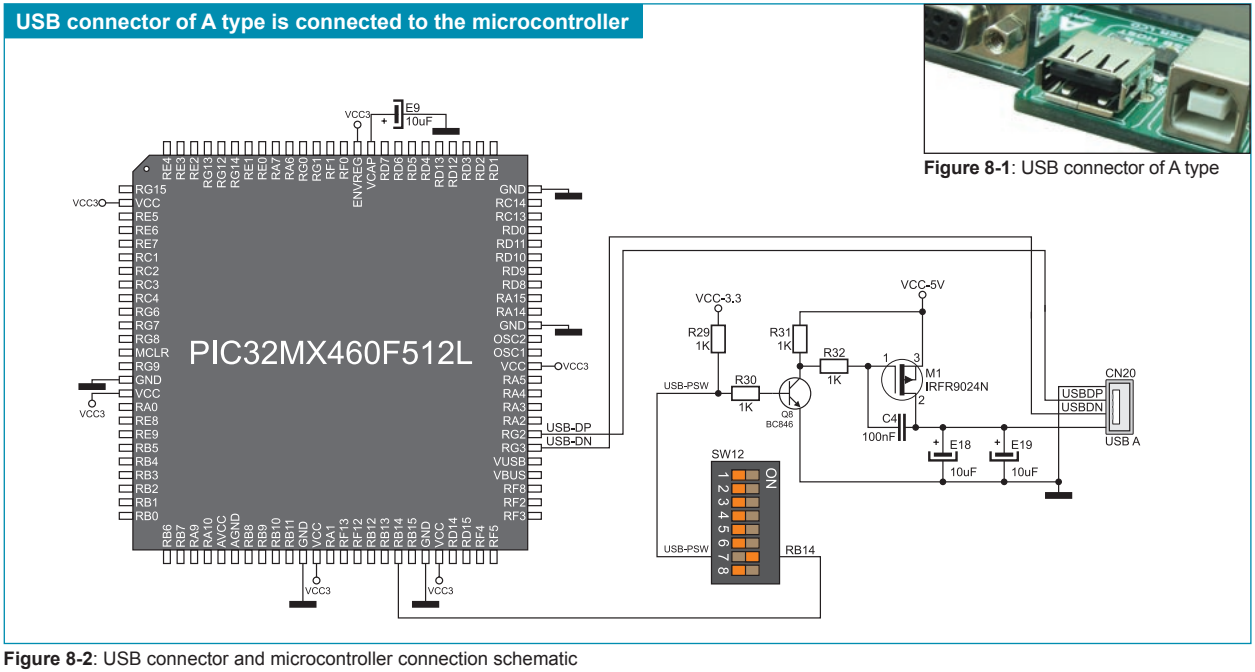

Figure 8-2: USB connector and microcontroller connection schematic

9.0. RS-232 Communication Module

USART (*Universal Synchronous/Asynchronous Receiver/Transmitter*) is one of the most common ways of exchanging data between the PC and peripheral units. RS-232 serial communication is performed through a 9-pin SUB-D connector and the microcontroller USART module. The *LV32MX v6* provides two RS-232 ports, RS-232A and RS-232B. Use switches 1, 2, 3 and 4 on the DIP switch SW15 to enable port RS-232A. Likewise, use switches 5, 6, 7 and 8 on the DIP switch SW15 to enable port RS-232B. The microcontroller pins used in such communication are marked as follows: RX - *receive data line*, TX - *transmit data line*, CTS - *clear to send* and RTS - *request to send*. Data rate goes up to 115 kbps.

In order to enable the USART module of the microcontroller to receive input signals which meet the RS-232 standard, it is necessary to adjust voltage levels using an IC circuit such as MAX3232CDR.

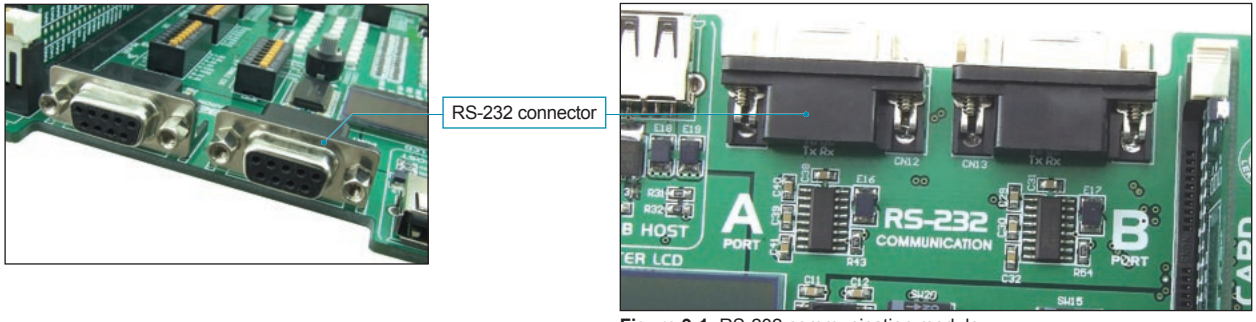

Figure 9-1: RS-232 communication module

Port RS-232A is connected to the microcontroller via RF2, RF8, RD14 and RD15 pins

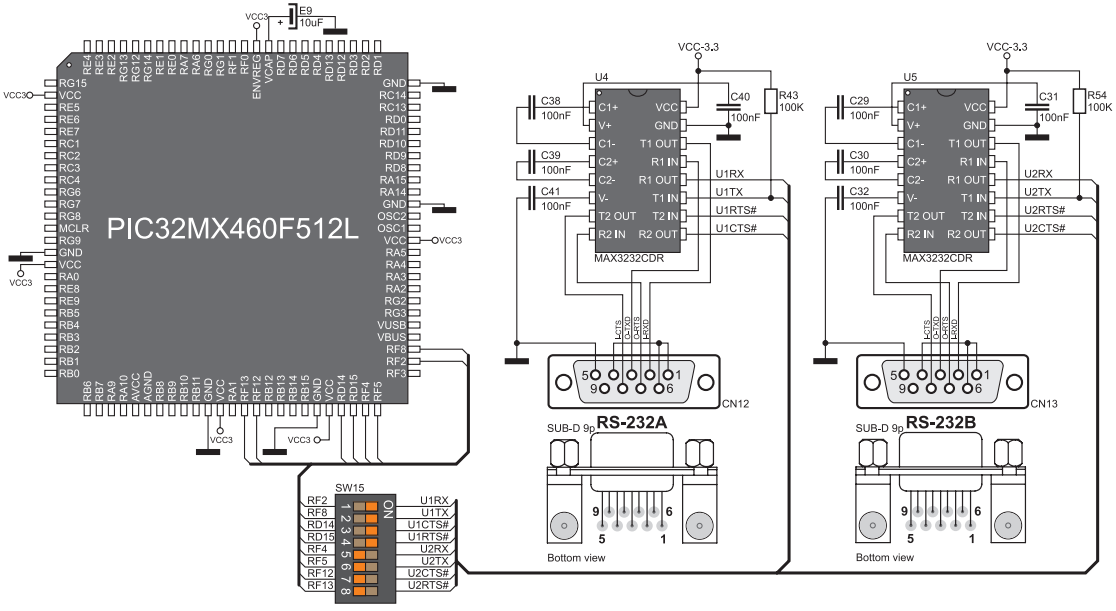

Figure 9-2: RS-232 communication module and microcontroller connection schematic

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10.0. CAN Communication Module

CAN (Controller Area Network) is a communication standard primarily intended for use in automotive industry. It enables the microcontroller to communicate to a car device without using a host PC. In addition, such communication is widely used in industrial automation. The *LV32MX v6* uses the MCP2551 circuit for CAN communication. This circuit provides an interface between the microcontroller and some peripheral device. To enable connection between the microcontroller and MCP2551, it is necessary to set switches 1 and 3 on the DIP switch SW16 to ON position. For the same purpose can be used switches 2 and 4 on the DIP switch SW16. Which of these switches is to be used depends solely on the arrangement of the microcontroller pins connected to CAN communication lines. The RX line is connected to the microcontroller via RF0 and RG0 microcontroller pins, whereas the TX line is connected to the microcontroller via RF1 and RG1 microcontroller pins.

Figure 10-1: CAN module

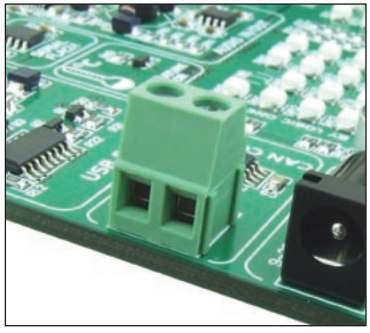

Figure 10-2: CAN module connector

CAN communication is enabled via DIP switch SW16

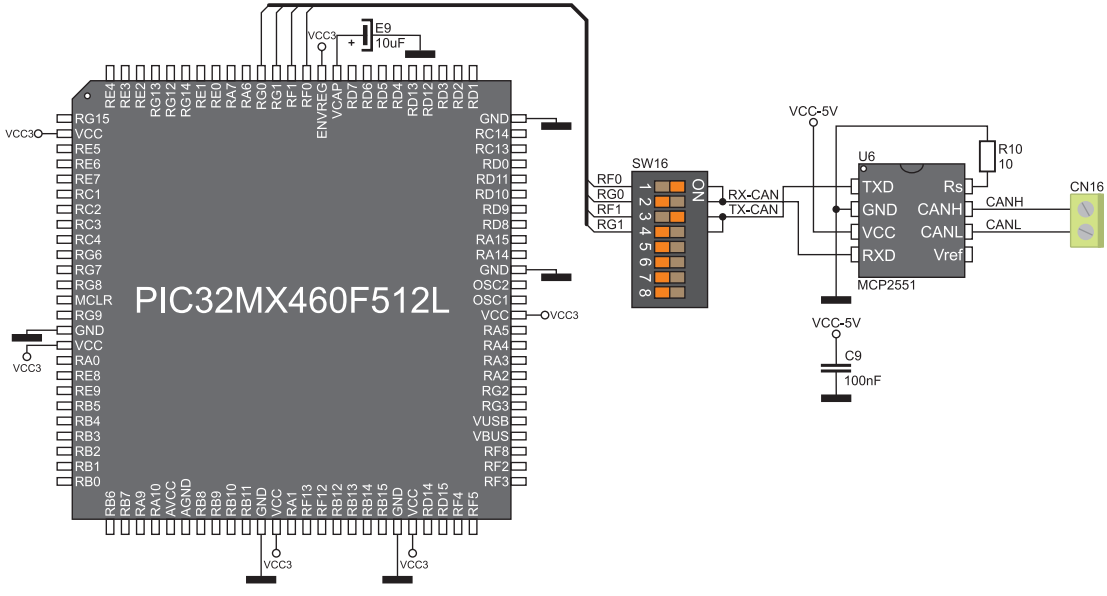

Figure 10-3: Microcontroller and MCP2551 connection schematic

11.0. MMC/SD Connector

The MMC/SD connector, provided on the development system, serves as an interface for memory cards, which enables the expansion of the memory available to the microcontroller. The microcontroller communicates with these memory cards by means of serial communication. To enable it, it is necessary to set switches 4-8 on the DIP switch SW13 to ON position.

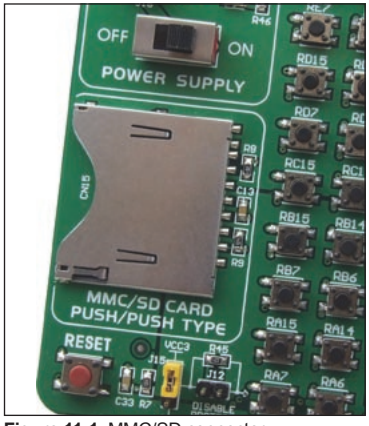

Figure 11-1: MMC/SD connector

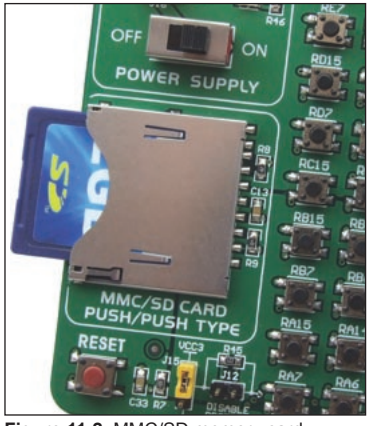

Figure 11-2: MMC/SD memory card

MMC/SD card communicates to the microcontroller via MISO, MOSI, SCK, MMC-CS and MMC-CD lines

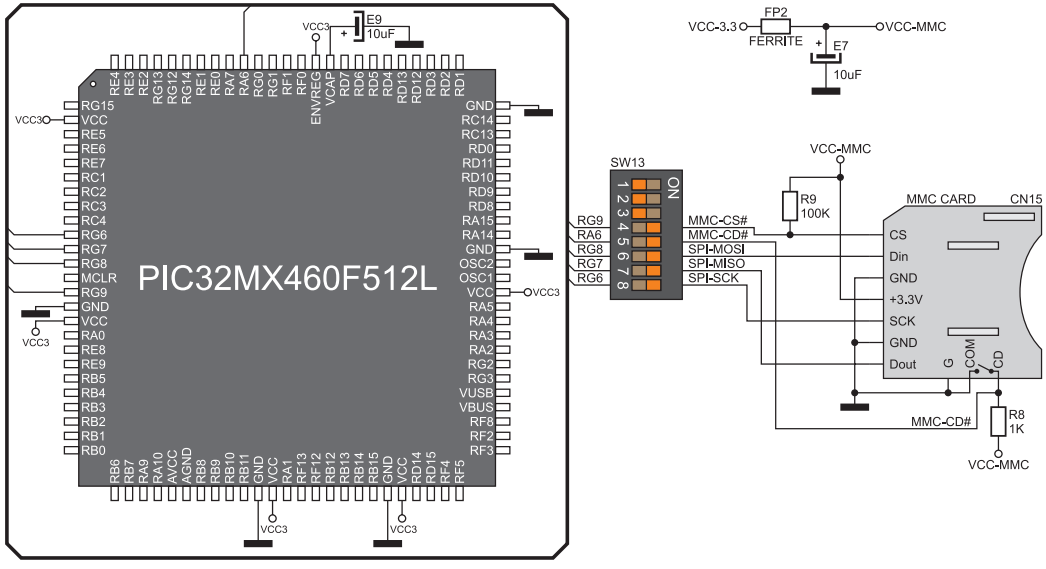

Figure 11-3: MMC/SD connector and microcontroller connection schematic

page

12.0. Temperature Sensor

A temperature measurement is one of the most commonly performed measurements. The *LV32MX v6* is capable of measuring temperature due to the MCP9700A circuit. The temperature range of this circuit goes from -40°C to +125°C, with accuracy of +/-2°C. The MCP9700A circuit converts temperature into an analog voltage signal which is then transferred to the RB8 microcontroller pin. The value of this voltage is temperature dependable and is converted into a digital number by means of the A/D converter provided within the microcontroller.

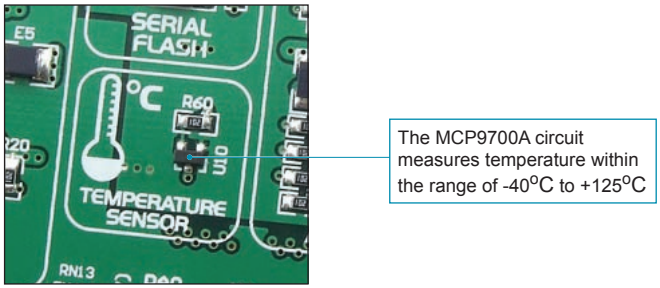

Figure 12-1: Temperature sensor

The RB8 microcontroller pin is fed with a signal sent by the MCP9700A circuit

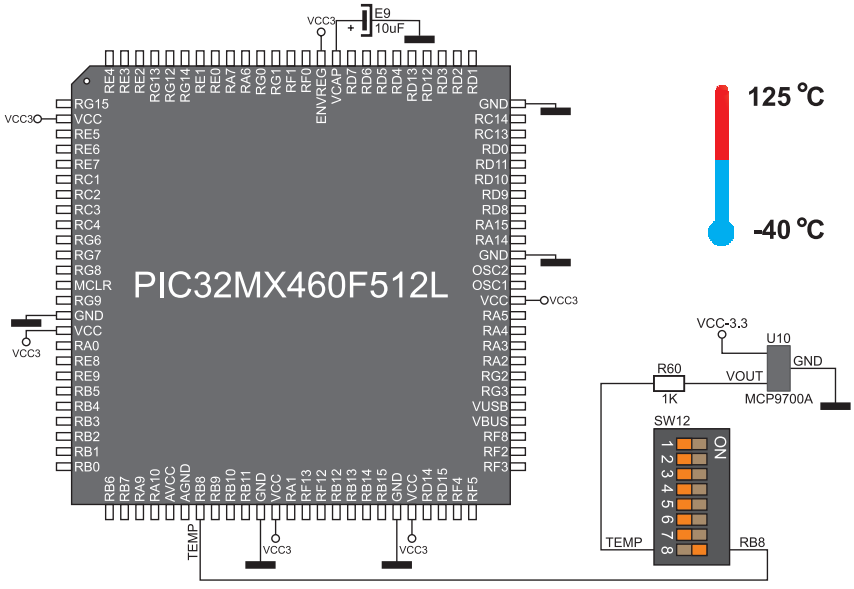

Figure 12-2: MCP9700A and microcontroller connection schematic

13.0. Joystick

A joystick is a movable stick that can be moved in several directions. Every movement can be registered by the microcontroller. The *LV32MX v6* provides a joystick which can be moved in four directions and serves as a push button. Its function is determined in the program written by the user and loaded into the microcontroller. However, the joystick can be assigned various functions. In this case, it is typically used for navigation through the user menu.

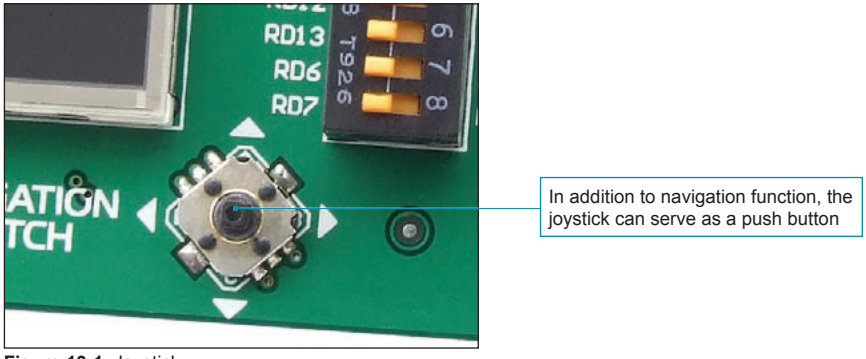

Figure 13-1: Joystick

Joystick has a navigation function

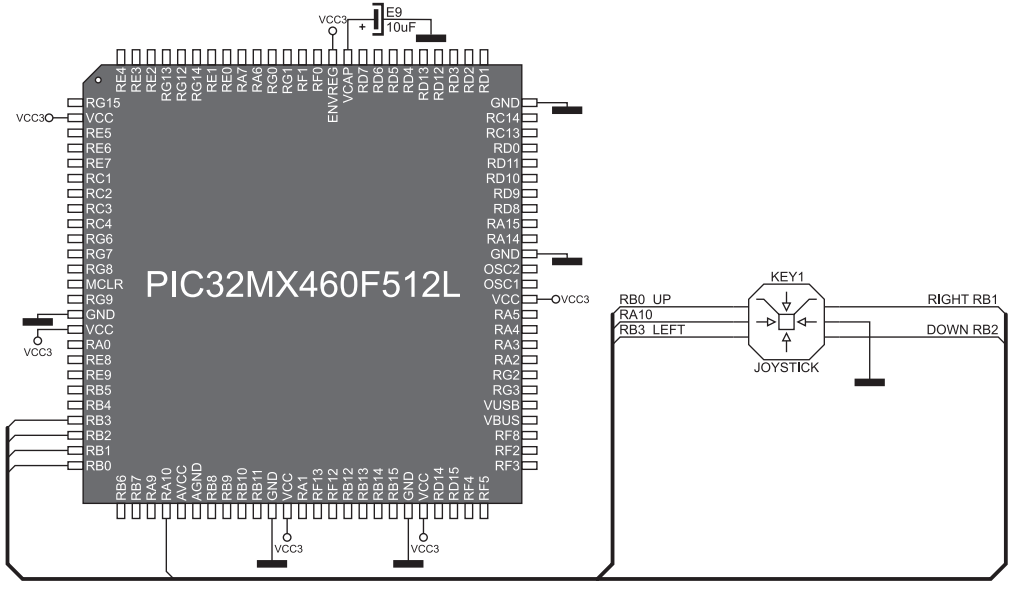

Figure 13-2: Joystick and microcontroller connection schematic

page

14.0. FLASH Module

Since multimedia applications are getting increasingly demanding, it is necessary to provide additional memory space to be used for storing programs by the microcontroller. The M25P80 circuit enables the microcontroller to use additional 8Mbit flash memory. In order to connect this memory to the microcontroller, it is necessary to set switches 6, 7 and 8 on the DIP switch SW13 as well as switch 1 on the DIP switch SW19 to ON position.

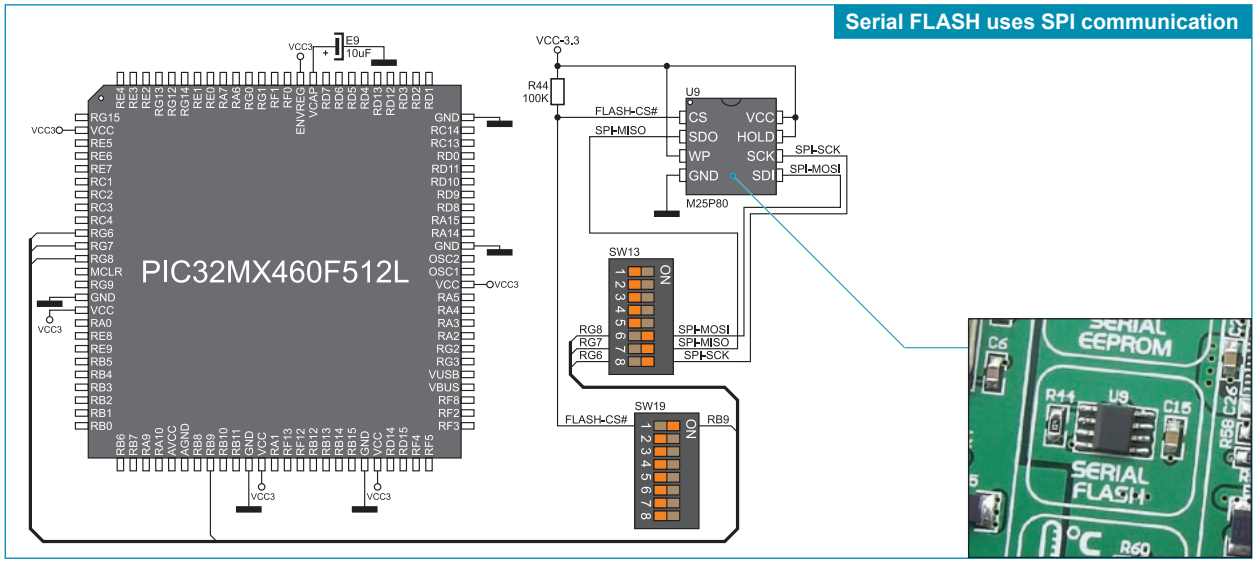

Figure 14-1: Flash memory and microcontroller connection schematic

15.0. EEPROM Module

EEPROM (Electrically Erasable Programmable Read-Only Memory) is a built-in memory module used to store data that must be saved when power goes off. The 24AA01 circuit is capable of storing up to 1Kbit data and uses serial I^{2}C communication to exchange data with the microcontroller via its pins RA3 and RA2 or RF4 and RF5.

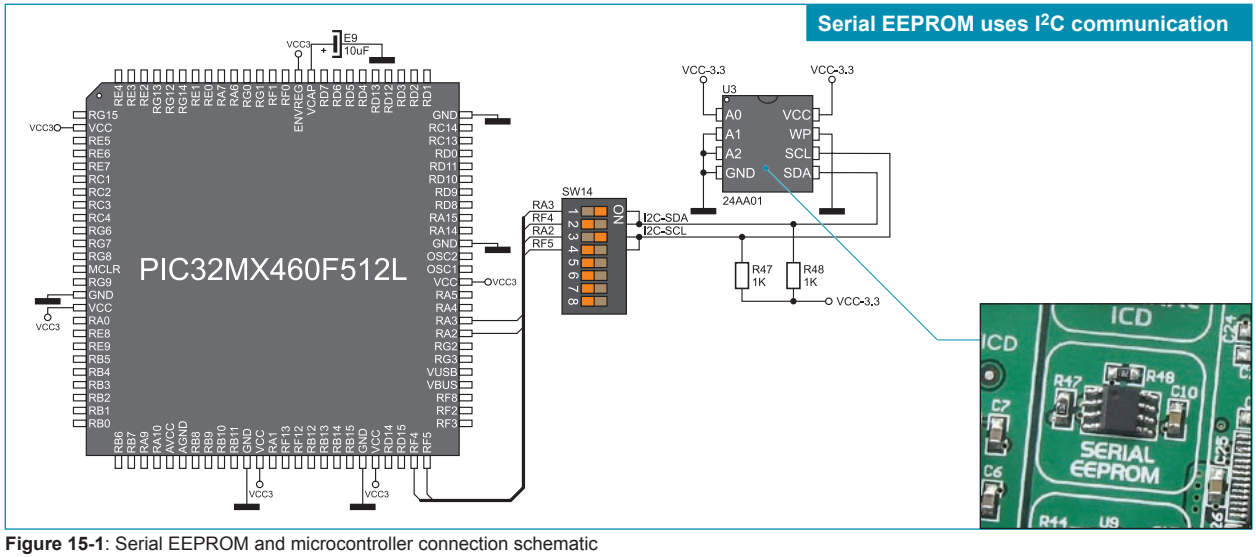

Figure 15-1: Serial EEPROM and microcontroller connection schematic

16.0. Audio Module

Due to the on-board audio module, the *LV32MX v6* development system can be connected both to a microphone and headphones.

A microphone can be interfaced to the system via a 3.5mm connector CN23 and the WM8731SEDS circuit. This circuit is a stereo CODEC with an integrated headphones driver. Its function is to convert an analog signal from interfaced microphone to a digital value, then to transfer it to a microcontroller or as a sidetone to headphones output. A sidetone volume control can be programmed by a software so an additional potentiometer is not necessary. In case the microphone signal is transferred to headphones as a sidetone, it is necessary to set jumpers J13 and J14 to ACD position, as shown in Figure 16-3. It causes the WM8731SEDS headphones output to be connected to the 3.5mm headphones connector CN22. The WM8731SEDS output signal is transferred to the connector CN22 via LHPO and RHPO lines. Figure 16-5 (page 20) illustrates connection between jumpers, LHPO and RHPO lines and the CN22 connector.

The *LV32MX v6* development system is also able to generate an audio signal using WM8731SEDS or MCP6022 circuit. The WM8731SEDS is used to convert digital data from the microcontroller to audio signal to be transferred to headphones. Communication between this circuit and the microcontroller is performed via SPI serial interface. The MCP6022 circuit is used for filtering PWM signal generated by the microcontroller. The headphones may be connected to the system using a 3.5mm connector CN22. The function of jumpers J13 and J14 is to select a signal to be transferred to the 3.5mm connector. When jumpers J13 and J14 are set to PWM position, as shown in Figure 16-4, the CN22 connector is fed with a signal from the MCP6022 circuit. When jumpers J13 and J14 are set to ACD positon, refer to Figure 16-3, the CN22 connector is fed with an audio signal from the WM8731SEDS circuit via LHPO and RHPO lines.

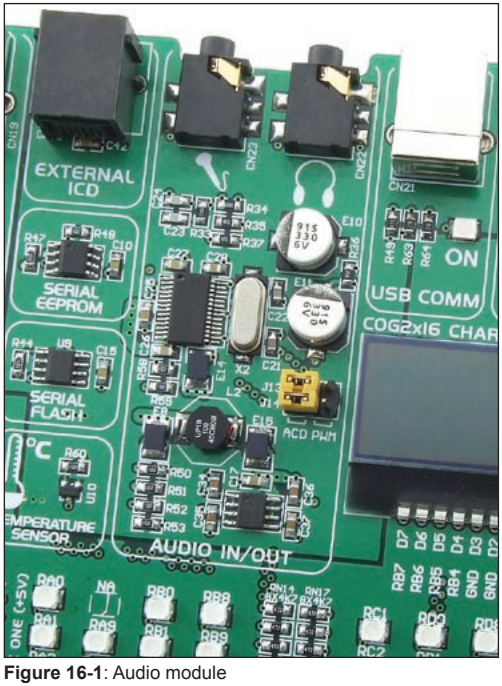

Figure 16-1: Audio module

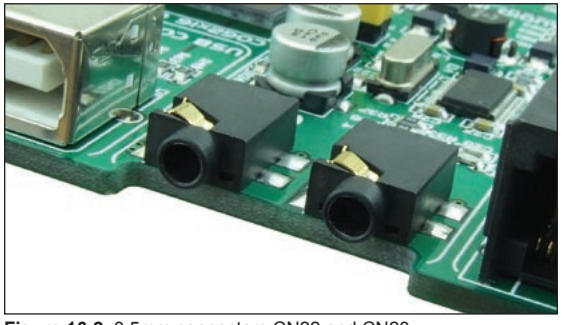

Figure 16-2: 3.5mm connectors CN22 and CN23

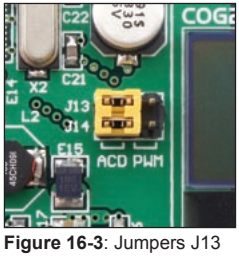

Figure 16-3: Jumpers J13 and J14 in ACD position

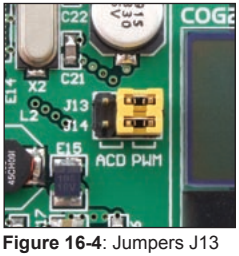

Figure 16-4: Jumpers J13 and J14 in PWM position

page

For the microcontroller to be connected to the audio module, it is necessary to turn on the switches on the DIP switches SW13, SW14 and SW20. In case the microcontroller is used for generating audio signals it is necessary to set switches 7 and 8 on the DIP switch SW20 to ON position. In case the WM8731SEDS circuit is used for the audio signal generation or microphone connection, it is necessary to set switches on the DIP switch SW14 to ON position. In addition, switches 1, 2 and 3 on the DIP switch SW13 can be optionally used. Which of DIP switches is to be used depends on the microcontroller pinout.

Circuit WM8731SEDS is used for generating audio signals and connecting microphone

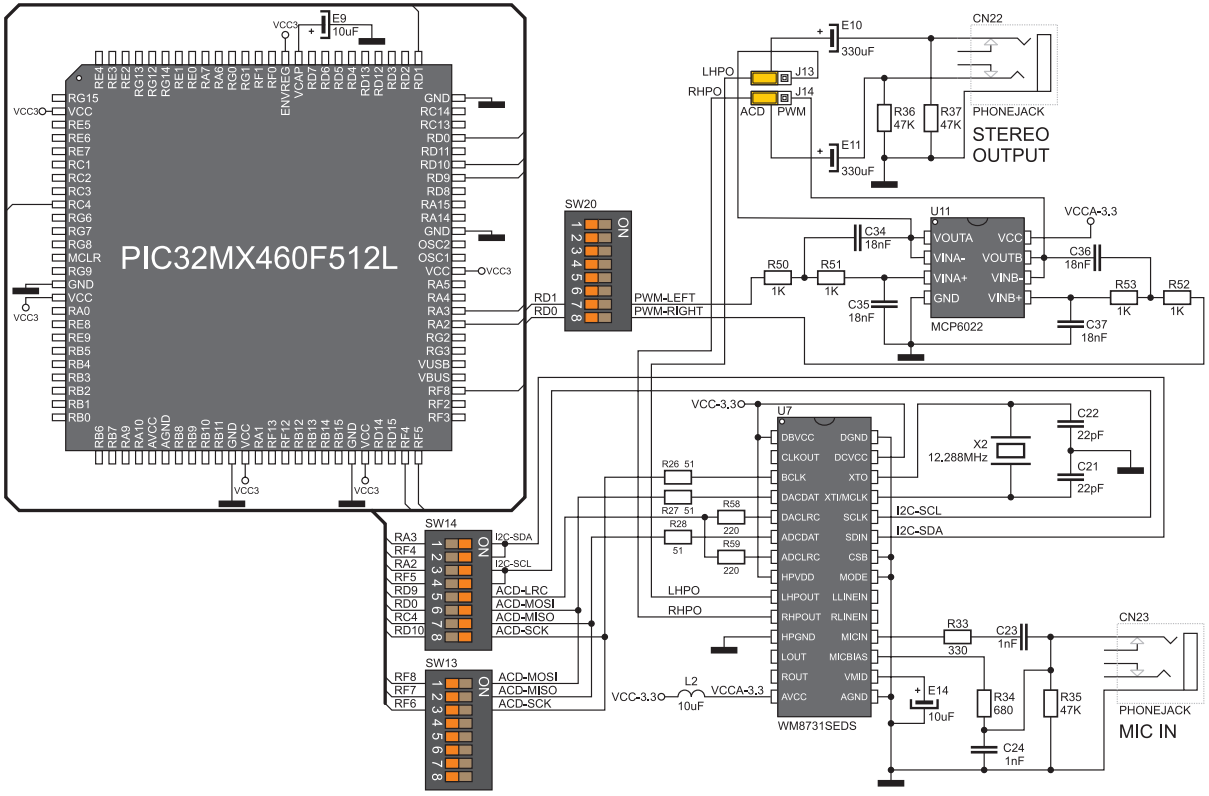

Figure 16-5: Audio module and microcontroller connection schematic

17.0. On-board 2x16 LCD

The on-board 2x16 LCD is connected to the microcontroller via the 74LVCC3245 transceiver. For this display to be used, it is necessary to set switches 1-6 on the DIP switch SW20 to ON position, thus connecting the display pins to the microcontroller port PORTB. Potentiometer P1 is used to adjust the display contrast.

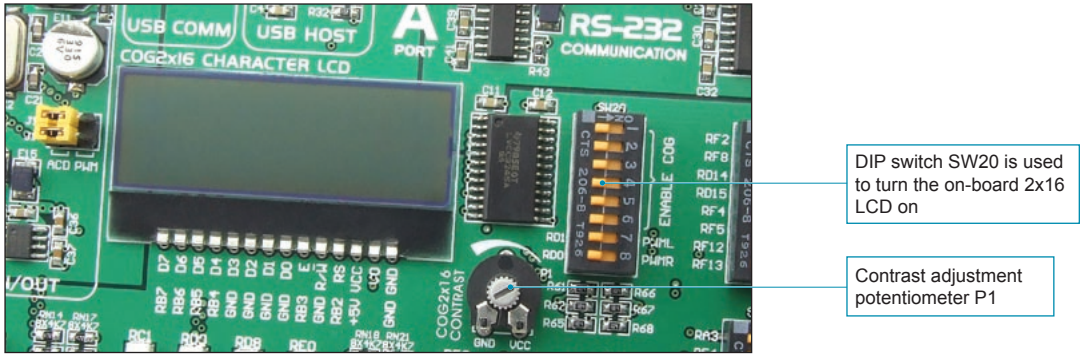

Figure 17-1: On-board 2x16 LCD

On-board 2x16 LCD is turned on via DIP switch SW20

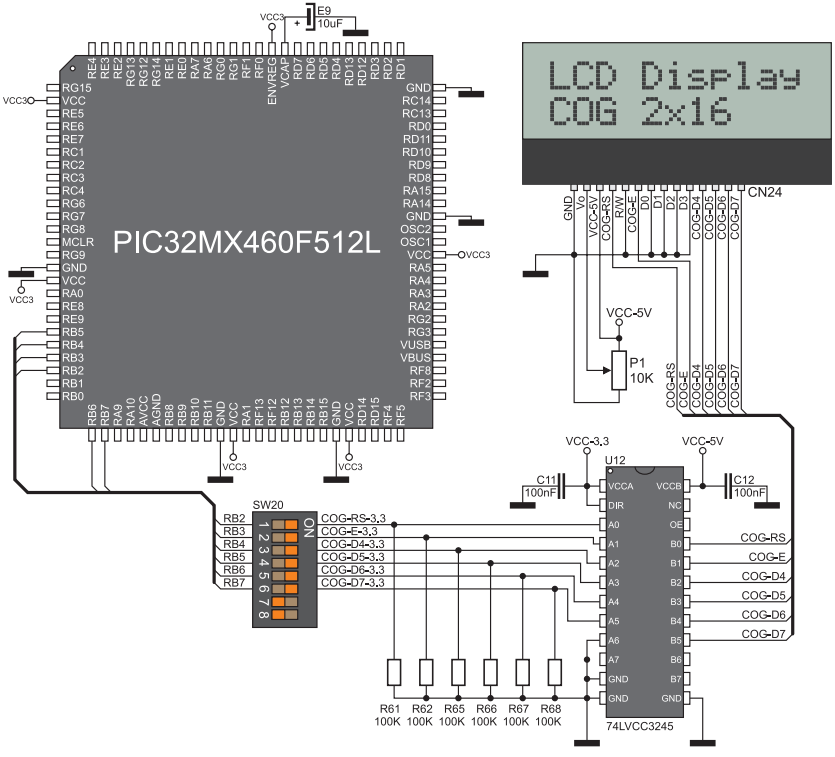

Figure 17-2: On-board 2x16 LCD connection schematic

page

18.0. TFT Display

The *LV32MX v6* features a TFT display in a resolution of 320x240 covered with a touch panel. It is capable of displaying 262.000 colours. The TFT display and touch panel together form a functional unit called a touch screen. The TFT display can be used for displaying pictures, videos and other graphic contents. Owing to the touch screen, it is possible to create interactive applications, such as virtual keyboard, when writing programs for the microcontroller. For the TFT display to be connected to the microcontroller, it is necessary to set all switches on the DIP switches SW17 and SW18, switches 2-8 on the DIP switch SW19 as well as switches 5-8 on the DIP switch SW16 to ON position.

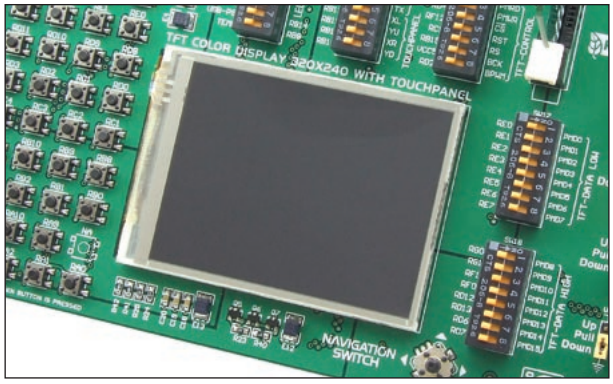

Figure 18-1: TFT display with touch panel

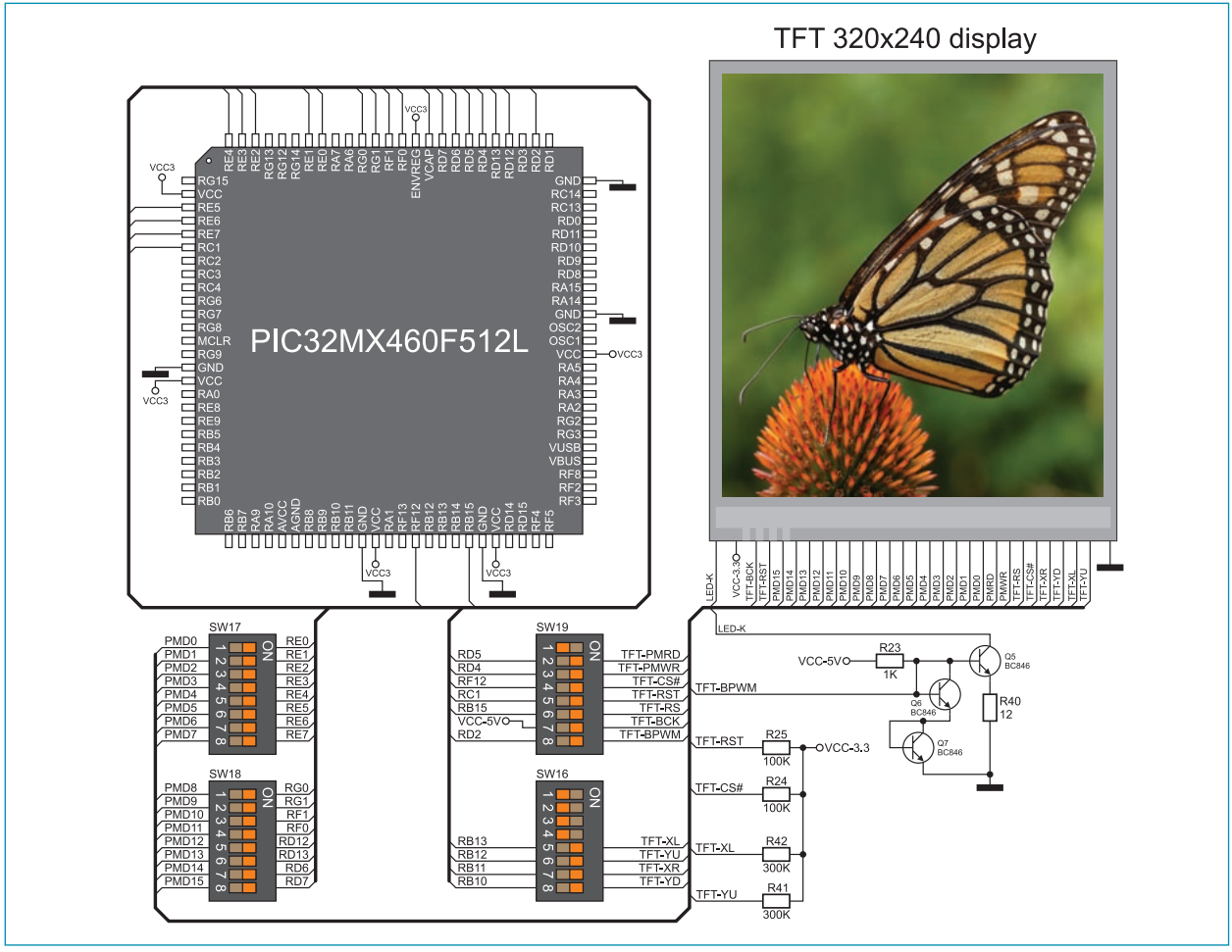

Figure 18-2: TFT display and microcontroller connection schematic

19.0. LEDs

LED (Light-Emitting Diode) is a highly efficient electronic light source. When connecting LEDs, it is necessary to use a current limiting resistor. A common LED voltage is approximately 2.5V, while the current varies from 1 to 20mA depending on the type of LED. The *LV32MX v6* uses LEDs with current I=1mA.

There are 85 LEDs on the *LV32MX v6* development system which visually indicate the state of each microcontroller I/O pin. An active LED indicates that a logic one (1) is present on the pin. In order to enable the pin state to be shown, it is necessary to select appropriate port (PORTA, PORTB, PORTC, PORTD, PORTE, PORTF, PORTF/G or PORTG) using DIP switch SW12.

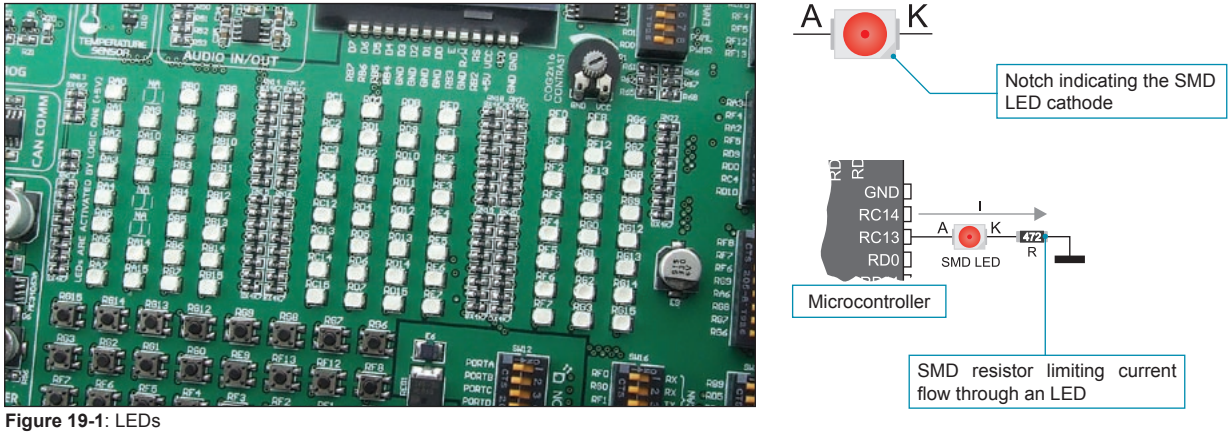

Figure 19-1: LEDs

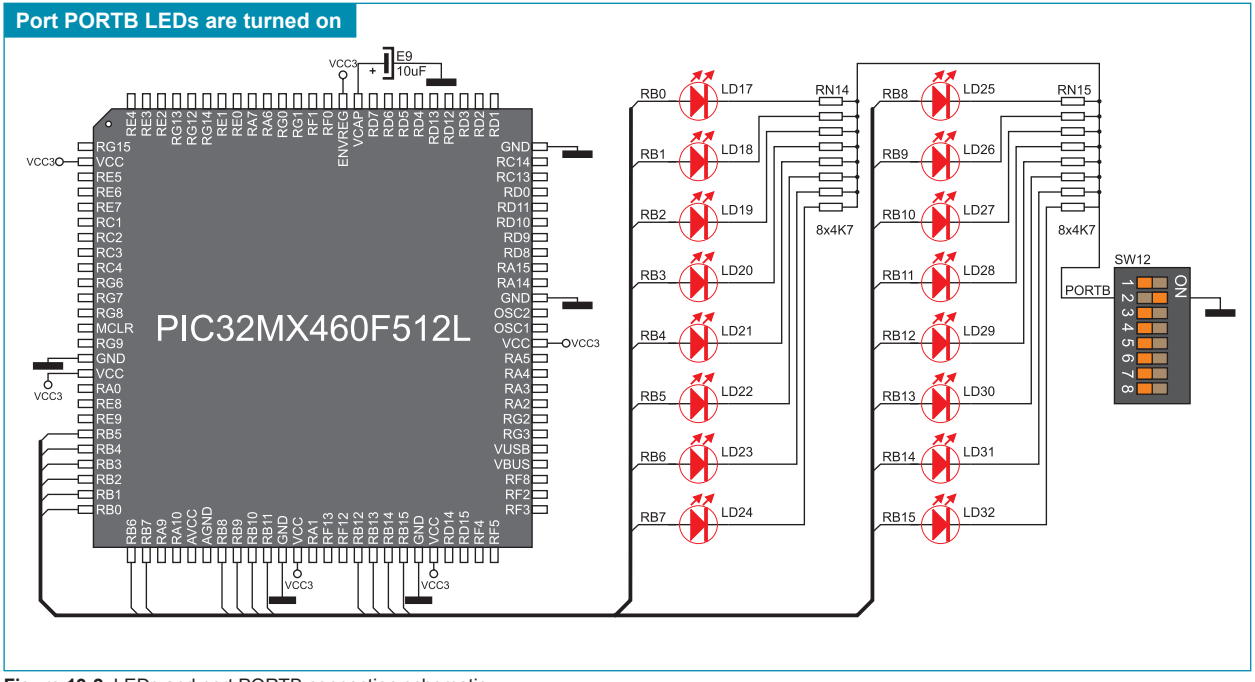

Figure 19-2: LEDs and port PORTB connection schematic

page

20.0. Push Buttons

The logic state of all microcontroller input pins may be changed by means of push buttons. Jumper J15 is used to determine the logic state to be applied to the desired microcontroller pin by pressing appropriate push button. The function of the protective resistor is to limit the maximum current, thus preventing the development system and peripheral modules from being damaged in case a short circuit occurs. If needed, advanced users may shorten this resistor using jumper J12. Right next to the push buttons, there is a RESET button which is used to provide the MCLR pin with the microcontroller reset signal over the on-board programmer.

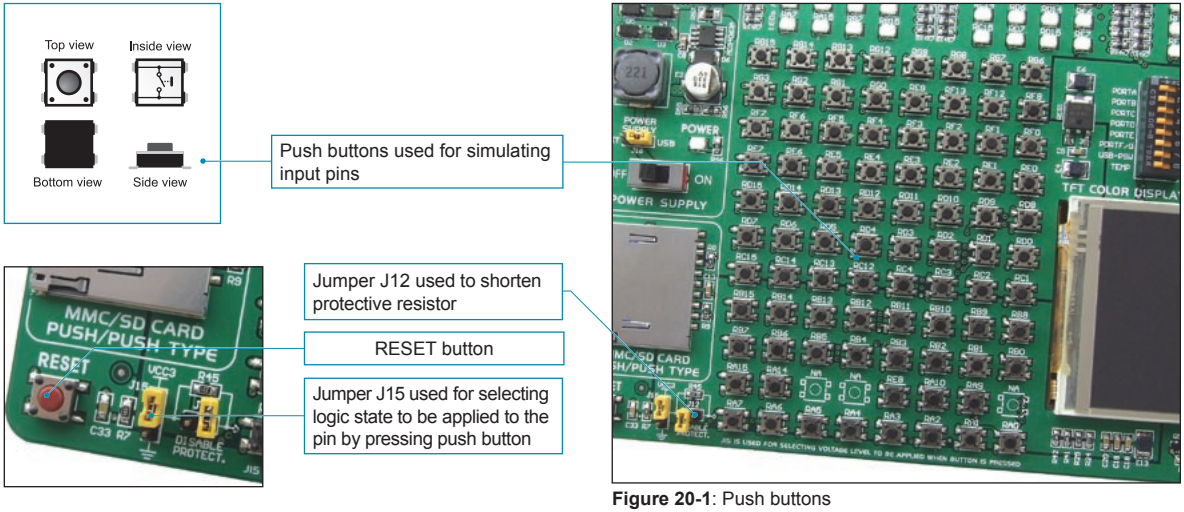
Top view
Inside view
Bottom view
Side view
Push buttons used for simulating input pins
Jumper J12 used to shorten protective resistor
RESET button
Jumper J15 used for selecting logic state to be applied to the pin by pressing push button
MMC/SD CARD PUSH/PUSH TYPE
RESET
TFT COLOR DISPLAY

Figure 20-1: Push buttons

By pressing any button when jumper J15 is in the VCC-3.3 position, a logic one (3.3V) will be applied to the appropriate microcontroller pin, as shown in Figure 20-2.

By pressing a push button, the appropriate pin will be driven high (1)

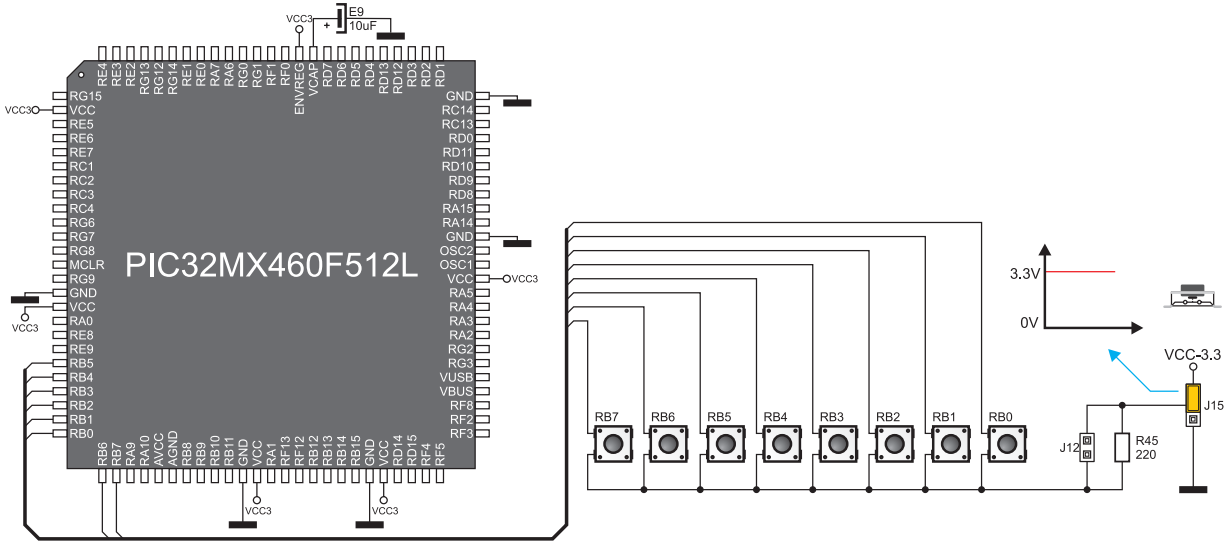

Figure 20-2: Push buttons and port PORTB connection schematic

21.0. Input/Output Ports

Along the right side of the development system, there are twelve 10-pin connectors connected to the microcontroller's I/O ports. Pins RB0, RB1 and mRST# are used for programming and therefore are not directly connected to the appropriate 10-pin connectors, but via the programmer's multiplexer. DIP switches SW1-SW11 enable each connector pin to be connected to one pull-up/pull-down resistor. Whether pins of some port are to be connected to a pull-up or a pull-down resistor depends on the position of jumpers J1-J11.

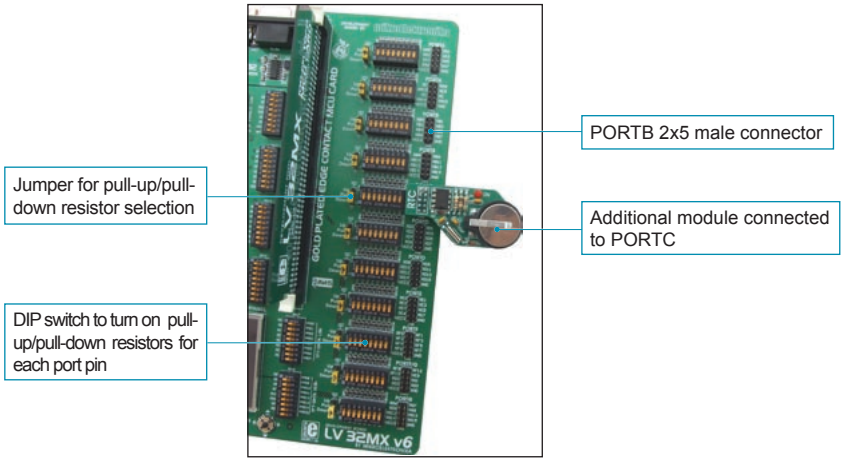
PORTB 2x5 male connector
Jumper for pull-up/pull-down resistor selection
Additional module connected to PORTC
DIP switch to turn on pull-up/pull-down resistors for each port pin

Figure 21-1: I/O ports

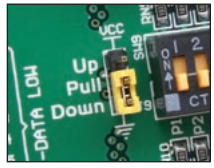

Figure 21-2: J9 in pull-down position

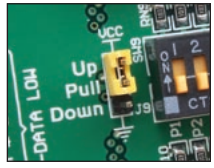

Figure 21-3: J9 in pull-up position

Port PORTB pins are connected to pull-down resistors

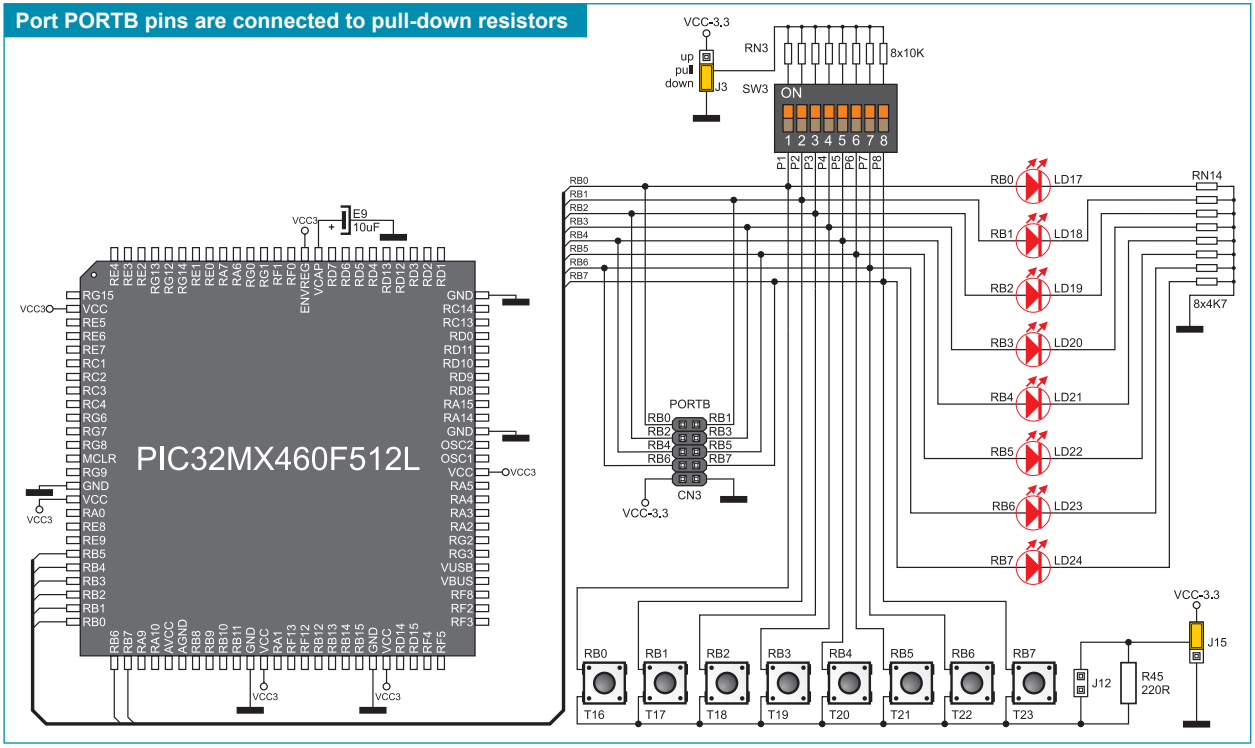

Figure 21-4: Port PORTB connection schematic

page

Pull-up/pull-down resistors enable you to set the logic level on all microcontroller's input pins when they are in idle state. Such level depends on the position of the pull-up/pull-down jumper. The RD8 pin with the relevant DIP switch SW7, jumper J7 and RD8 push button with jumper J15 are used here for the purpose of explaining the performance of pull-up/pull-down resistors. The principle of their operation is the same as for all other microcontroller pins.

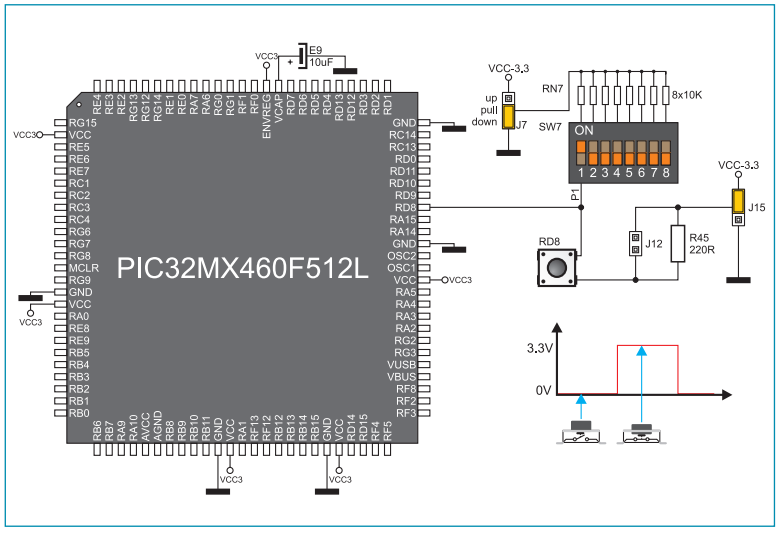

Figure 21-5: Jumper J7 in pull-down position and jumper J15 in pull-up position

In order to enable the PORTD port pins to be connected to pull-down resistors, it is necessary to place jumper J7 in the *Down* position first. This enables any PORTD port pin to be supplied with a logic zero (0V) in idle state over jumper J7 and 8x10k resistor network. To provide the RD8 pin with such signal, it is necessary to set switch P1 on the DIP switch SW7 to ON position.

As a result, every time you press the RD8 push button, a logic one (3.3V) will appear on the RD8 pin, provided that jumper J15 is placed in the VCC-3.3 position.

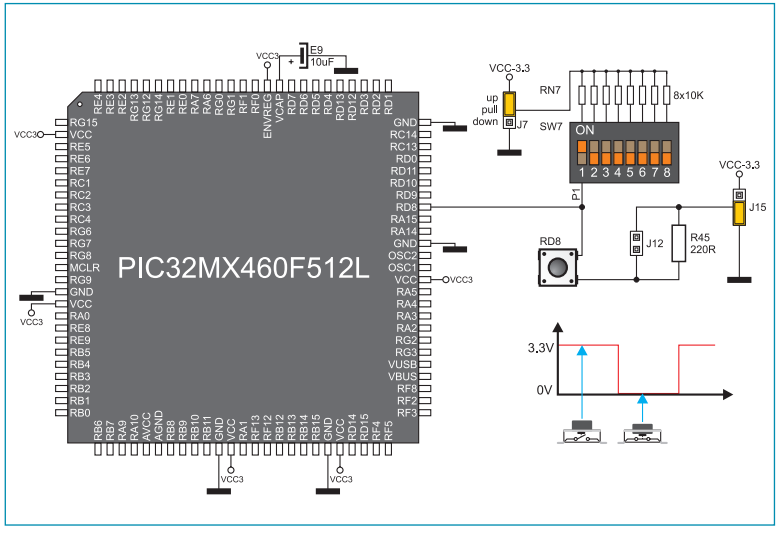

Figure 21-6: Jumper J7 in pull-up position and jumper J15 in pull-down position

In order to enable port PORTD pins to be connected to pull-up resistors and the port input pins to be supplied with a logic zero (0), it is necessary to place jumper J7 in the *Up* position and jumper J15 in the GND position. This enables any port PORTD input pin to be driven high (3.3V) in idle state over the 10k resistor.

As a result, every time you press the RD8 push button, a logic zero (0V) will appear on the RD8 pin, provided that the P1 switch is set to the ON position.

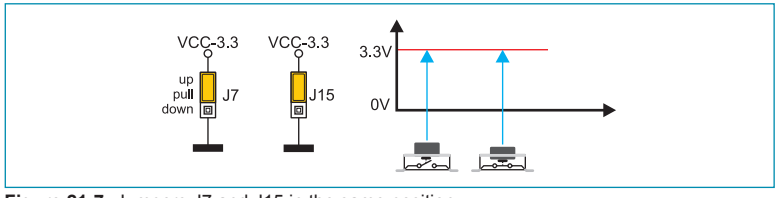

Figure 21-7: Jumpers J7 and J15 in the same position

In case that jumpers J7 and J15 have the same logic state, pressure on any button will not cause input pins to change their logic state.

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